DEFENSE INFORMATION SYSTEMS AGENCY
JOINT INTEROPERABILITY TEST COMMAND
P.O. BOX 12798
FORT HUACHUCA, ARIZONA 85670-2798

IN REPLY REFER TO: Battlespace Communications Portfolio (JTE) 28 August 2007

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of Cisco Assured Services Voice Application Local Area Network (ASVALAN) and Voice Application Local Area Network (VALAN) with Specified Software Releases

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems," 8 March 2006

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification. Additional references are provided in enclosure 1.

2. The Cisco ASVALAN and VALAN with Specified Software Releases is hereinafter referred to as the system under test (SUT). The SUT meets all of its critical interoperability requirements and is certified as interoperable for joint use within the Defense Switched Network (DSN). The SUT is certified for joint use within the DSN with the Digital Switching Systems on the DSN Approved Products List (APL) which are certified for use with an ASVALAN or VALAN. The SUT components which are bolded and underlined in the tables throughout this certification letter, are components that were tested in the JITC laboratory for this certification. The SUT components which are not bolded and not underlined, but also listed throughout the tables in this letter, are certified for joint use in the DSN as well. The JITC analysis determined these components to contain the same hardware and software and to be functionally identical to the tested components for interoperability certification purposes. The SUT is certified to support DSN Assured Services over Internet Protocol as an ASVALAN. If a system meets the minimum requirements for an ASVALAN, it also meets the lesser requirements for a VALAN. However, since VALANs do not support the Assured Services Requirements detailed in reference (c), Command and Control (C2) users and Special C2 users are not authorized to be served by a VALAN. VALANs shall only be employed to serve Department of Defense (DoD), non-DoD, non-governmental, and foreign government users having no missions or communications requirement to ever originate or receive C2 communications. VALAN connectivity to the DSN is not authorized unless a waiver is granted by the Joint Staff for each site. The SUT is certified for joint use as a VALAN for non-C2 traffic. The principal differences between an ASVALAN and VALAN include:

- C2 traffic shall not traverse a VALAN.

- A single point of failure, which could impact more than 64 telephony subscribers, is permitted and switch modularity is not required for a VALAN.
- Network Management features and requirements are not required for a VALAN.
- Reliability of 99.9% is the minimum requirement for a VALAN.
- Battery backup is not required for a VALAN.

Testing did not include video services or data applications; however, simulated data traffic was generated during testing to determine the SUT's ability to properly prioritize voice media and signaling traffic. This certification expires upon changes that could affect interoperability, but no later than three years from the date of this memorandum.

3. This finding is based on interoperability testing conducted by JITC and a review of the vendor's Letters of Compliance (LoC). Testing was conducted at JITC's Global Information Grid Network Test Facility at Fort Huachuca, Arizona, from 2 April through 22 May 2007. Review of the vendor's LoC was completed on 19 June 2007. Enclosure 2 documents the test results and describes the tested network. No other configurations, features, or functions, except those cited within this report, are certified or authorized for use within the DSN.

4. The overall interoperability status of the SUT is indicated in table 1. The ASVALAN and VALAN system requirements are listed in table 2. In addition to system level requirements, components that comprise the SUT must meet specific criteria to be certified for use as core, distribution, or access components. The interoperability status of the SUT components is listed in table 3. The ASVALAN and VALAN requirements used to certify the components are listed in table 4. This interoperability test status is based on the SUT's ability to meet:

a. Assured services as defined in reference (c).

b. Local Area Network system requirements specified in reference (d) verified through JITC testing and/or vendor submission of LoC.

c. Internet Protocol version 6 requirements specified in reference (d), paragraph 1.7, table 1-4, by 30 June 2008 in accordance with reference (e) verified through vendor submission of LoC signed by the Vice President of the company.

d. The overall system interoperability performance derived from test procedures listed in reference (f).

Table 1. SUT Interoperability Status

System Interoperability Status			
Components[1, 2]	**Release**	**Status**	**Remarks**
Cisco Catalyst 6500 Series Switches		Certified	All ASVALAN and VALAN system requirements were met when the SUT was configured in accordance with architecture provided in enclosure 2. Additional details about component level certification are provided in table 3. Security testing is accomplished through DISA-led Information Assurance Test teams and published in a separate report.
Cisco **6509**/**6509-E**/6509-NEB/6509-NEB-A/ 6503/6503-E/6504-E/6506/6506-E/6513	Native IOS 12.2 (18) SXF7 Release Software (fc1)		
Cisco Catalyst 4500 Series Switches			
Cisco **4507R**/4503[3]/4506[3]/4510R	IOS 12.2 (31) SGA1 Release Software (fc3)		
Cisco Catalyst 3750 Series Switches (See note 4.)			
WS-C3750G-12S-E WS-C3750G-12S-S WS-C3750G-12S-SD **WS-C3750-24PS-E** WS-C3750-24FS-S WS-C3750-24PS-S WS-C3750-24TS-S WS-C3750-24TS-E **WS-C3750-48PS-E** WS-C3750-48PS-S WS-C3750-48TS-S WS-C3750-48TS-E **WS-C3750G-48PS-E** WS-C3750G-24T-S WS-C3750G-24T-E WS-C3750G-24TS-S WS-C3750G-24TS-E WS-C3750G-24TS-S1U WS-C3750G-24TS-E1U WS-C3750G-24PS-S WS-C3750G-24PS-E WS-C3750G-48TS-E WS-C3750G-48PS-S	IOS 12.2 (35) SE2 Release Software (fc1)		
Cisco Catalyst 3550 Series Switches			
WS-C3550-24PWR-EMI[2,5] WS-C3550-48-EMI WS-C3550-24-EMI	IOS 12.2 (35) SE Release Software (fc2)		

LEGEND:

ASVALAN	- Assured Services Voice Application Local Area Network	L2	- Layer 2
DISA	- Defense Information Systems Agency	L3	- Layer 3
DC	- Direct Current	PS	- Pre-Standard
DSN	- Defense Switched Network	PWR	- Power over Ethernet
G	- Gigabit	S	- Standard
E	- Enhanced	SD	- SFP-DC power
EMI	- Enhanced Multilayer Software Image	SUT	- System Under Test
FS	- Fiber Switch	SFP	- Small Form Factor Pluggable
GSCR	- Generic Switching Center Requirements	T, TS	- Twisted Pair
IOS	- Internetwork Operating System	U	- Rack Unit
IPv6	- Internet Protocol version 6	VALAN	- Voice Application Local Area Network
JITC	- Joint Interoperability Test Command	WS	- Workgroup Switch

NOTES:

1 Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same IOS software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.

2 All of the SUT components covered under this certification met the IPv6 criteria with the exception of the Catalyst 3550. The Catalyst 3550 does not meet the critical IPv6 capability requirement in accordance with the GSCR, paragraph 1.7. However, components that are not currently IPv6 capable and have been identified by the vendor as having no migration path to IPv6, may be certified if the following criteria are met:
   a. The component must already be JITC certified and currently fielded within the DSN.
   b. There must be a certified, IPv6-capable component available for replacement. The Catalyst 3560 is the designated replacement.

3 Indicates these switches support one processor and must be configured to fail over to a redundant distribution switch.

4 Refer to enclosure 2, paragraph 11 a. (3). Due to a tagging problem with L2 and L3 on the Catalyst 3750 switch after a processor fail over, only the "auto qos voip trust" access port command is certified. The Cisco proprietary "auto qos cisco-phones" command is not authorized nor approved for use within the DSN.

5 The Catalyst 3550 was tested for shared access however; it failed to meet the GSCR requirements. The Catalyst 3550 is not certified for shared access and is not authorized nor approved for use within the DSN for shared access.

Table 2. ASVALAN and VALAN System Requirements

System Requirements				
Requirement	**Criteria**		**Reference**	**Critical**
Delay	One-way packet delay for voice packets of an established call (signaling and media) shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.1	Yes
Jitter	For voice media packets, jitter shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.2	Yes
Packet Loss	Voice packet loss within the LAN shall not exceed 0.05% averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.3	Yes
Reliability	ASVALAN	- ASVALANs shall have a reliability of .99999 - No single point of failure for outage of more than 64 telephony subscribers - Network Path restores within 2 seconds	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
	VALAN	- VALANs shall have a reliability of .999	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
IPv6[1]	All IP devices shall be IPv6 capable.		GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	Yes
Security[2]	DIACAP (replacement for DITSCAP)/IA		GSCR, Appendix 3, paragraph A.3.3.4.3	Yes

LEGEND:

ASVALAN	- Assured Services Voice Application LAN	IP	- Internet Protocol
DIACAP	- DoD IA Certification and Accreditation Process	IPv4	- Internet Protocol version 4
DISA	- Defense Information Systems Agency	IPv6	- Internet Protocol version 6
DITSCAP	- DoD IT Security Certification and Accreditation Process	IT	- Information Technology
DoD	- Department of Defense	LAN	- Local Area Network
GSCR	- Generic Switching Center Requirements	ms	- milliseconds
IA	- Information Assurance	VALAN	- Voice Application LAN

NOTES:

1 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria by 30 June 2008**:**

a. Conformant with IPv6 standards profile contained in the DoD IT Standards Registry (DISR).
b. Maintaining interoperability in heterogeneous environments and with IPv4.
c. Commitment to upgrade as the IPv6 standard evolves.
d. Availability of contractor/vendor IPv6 technical support.

2 Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 3. SUT Component Interoperability Status

Component Interoperability Status					
Component[1]	**Release**	**Sub-component**[1]	**Status**	**Layer(s)**	**Remarks**
Cisco Catalyst 6500 Series Switches		**WS-SUP720-3BXL**	Certified	Core, Distribution, Access	All CRs and FRs were met.
Cisco **6509**/**6509-E** /6509-NEB/6509-NEB-A/ 6503/6503-E /6504-E/6506/6506-E /6513	Native IOS 12.2 (18) SXF7 Release Software (fc1)	WS-SUP720-3B	Certified		
		WS-SUP720	Certified		
		WS-SUP32-GE-3B[2]	Certified		
		WS-X6K-SUP2-2GE[3]	Certified		
		WS-X6K-S2U-MSFC2[3]	Certified		
		WS-X6K-S2-MSFC2[3]	Certified		
		WS-X6148-RJ45V	Certified		
		WS-X6148-RJ-45	Certified		
		WS-X6148-RJ-21	Certified		
		WS-X6148-RJ21V	Certified		
		WS-X6148-45AF	Certified		
		WS-X6148-21AF	Certified		
		WS-X6148V-GE-TX	Certified		
		WS-X6148-GE-TX	Certified		
		WS-X6148-GE-45AF	Certified		
		WS-X6148A-GE-45AF	Certified		
		WS-X6148A-GE-TX	Certified		
		WS-X6148A-RJ-45	Certified		
		WS-X6148A-45AF	Certified		
		WS-X6348-RJ45V	Certified		
		WS-X6348-RJ-45	Certified		
		WS-X6348-RJ21V	Certified		
		WS-X6516-GBIC	Certified		
		WS-X6516A-GBIC	Certified		
		WS-X6516-GE-TX	Certified		
		WS-X6548V-GE-TX	Certified		
		WS-X6548-GE-TX	Certified		
		WS-X6548-RJ-21	Certified		
		WS-X6548-RJ-45	Certified		
		WS-X6548-GE-45AF	Certified		
		WS-X6816-GBIC	Certified		
		WS-X6748-SFP	Certified		
		WS-X6724-SFP	Certified		
		WS-X6748-GE-TX	Certified		
		WS-X6708-10G-3CXL	Certified		
		WS-X6708-10G-3C	Certified		

Table 3. SUT Component Interoperability Status (continued)

Component Interoperability Status					
Component[1]	**Release**	**Sub-component**[1]	**Status**	**Layer(s)**	**Remarks**
Cisco Catalyst 4500 Series Switches		**WS-X4516-10GE (SupV)**[4]	Certified	Core[7], Distribution[7], Access	All CRs and FRs were met.
Cisco **4507R**/4503[6]/4506[6] /4510R	IOS 12.2 (31) SGA1 Release Software (fc3)	WS-X4516 (SupV)[4]	Certified		
		WS-X4013+10GE(SUP2+)[5]	Certified		
		WS-X4013+[5]	Certified		
		WS-X4306-GB	Certified		
		WS-X4302-GB	Certified		
		WS-X4148-RJ45V	Certified		
		WS-X4124-RJ45	Certified		
		WS-X4148-RJ45	Certified		
		WS-X4148-RJ21	Certified		
		WS-X4232-GB-RJ	Certified		
		WS-X4232-RJ-XX	Certified		
		WS-X4248-RJ45V	Certified		
		WS-X4248-RJ21V	Certified		
		WS-X4224-RJ45V	Certified		
		WS-X4548-GB-RJ45V	Certified		
		WS-X4548-GB-RJ45	Certified		
		WS-X4524-GB-RJ45V	Certified		
Cisco Catalyst 3750 Series Switches (See note 8.)		Not Applicable	Certified	Distribution, Access	All CRs and FRs were met.
WS-C3750G-12S-E WS-C3750G-12S-S WS-C3750G-12S-SD **WS-C3750-24PS-E** WS-C3750-24FS-S WS-C3750-24PS-S WS-C3750-24TS-S WS-C3750-24TS-E **WS-C3750-48PS-E** WS-C3750-48PS-S WS-C3750-48TS-S WS-C3750-48TS-E **WS-C3750G-48PS-E** WS-C3750G-24T-S WS-C3750G-24T-E WS-C3750G-24TS-S WS-C3750G-24TS-E WS-C3750G-24TS-S1U WS-C3750G-24TS-E1U WS-C3750G-24PS-S WS-C3750G-24PS-E WS-C3750G-48TS-E WS-C3750G-48PS-S	IOS 12.2 (35) SE2 Release Software (fc1)				
Cisco Catalyst 3550 Series Switches		Not Applicable	Certified	Access	All CRs and FRs were met with the following minor exceptions: IPv6 was not met.[9] Shared access was not met with this device.[10]
WS-C3550-24PWR-EMI WS-C3550-48-EMI WS-C3550-24-EMI	IOS 12.2 (35) SE Release Software (fc2)				

Table 3. SUT Component Interoperability Status (continued)

LEGEND:

802.3af	- Standard for Carrier Sense Multiple Access with Collision Detection (CSMA/CD)	IPv6	- Internet Protocol version 6
AF	- PoE IEEE 802.3af Standard	JITC	- Joint Interoperability Test Command
ASVALAN	- Assured Services Voice Application Local Area Network	L2	- Layer 2
CRs	- Capability Requirements	L3	- Layer 3
DC	- Direct Current	MSFC	- Multilayer Switch Feature Card
DSN	- Defense Switched Network	PoE	- Power Over Ethernet
G, Gig	- Gigabit	PS	- Pre-Standard
GBIC	- Gigabit Interface Card	PWR	- Power over Ethernet
GE	- Gigabit Ethernet	RJ	- Registered Jack
E	- Enhanced	S	- Standard
EMI	- Enhanced Multilayer Software Image	SD	- SFP-DC power
FRs	- Feature Requirements	SFP	- Small Form Factor Pluggable
FS	- Fiber Switch	SUP	- Supervisor
GSCR	- Generic Switching Center Requirements	SUT	- System Under Test
IEEE	- Institute of Electrical and Electronics Engineers, Inc.	T, TS, TX	- Twisted Pair
IOS	- Internetwork Operating System	U	- Rack Unit
		WS	- Workgroup Switch

NOTES:

1 Components and sub-components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same IOS software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.

2 The SUP32 processor and its associated 1 Gig interfaces was tested and is only certified for an ASVALAN in a single processor dual 6500 series chassis configuration.

3 The SUP2 processor and its associated 1 Gig interfaces was tested and is only certified for an ASVALAN in a single or dual processor, dual 6500 series chassis configuration. Furthermore, the SUP2 processor is also certified in a dual processor single chassis configuration; however, in this configuration the 1 Gig interfaces are not certified for use nor approved for use within the DSN.

4 The SUPV processor includes both 1 Gig and 10 Gig fiber interfaces are covered under this certification. Both interfaces were tested and are authorized for use within the DSN.

5 The 4500 series SUP2+ processor 1 Gig and 10 Gig fiber ports did not meet the GSCR fail over requirements in a dual processor single chassis configuration in an ASVALAN. Therefore, the SUP2+ 1 Gig and 10 Gig fiber interfaces are not certified and are not authorized nor approved for use with the DSN in this configuration. The SUP2+ 1 Gig and 10 Gig fiber ports are certified for use in a single processor per chassis configuration in an ASVALAN or in a VALAN.

6 Indicates these switches support one processor and must be configured to fail over to a second switch.

7 The Catalyst 4500 series is certified in the core and distribution layer only with the SupV processor.

8 Refer to enclosure 2, paragraph 11 a. (3). Due to a tagging problem with L2 and L3 on the Catalyst 3750 switch after a processor fail over, only the "auto qos voip trust" access port command is certified. The Cisco proprietary "auto qos cisco-phones" command is not authorized nor approved for use within the DSN.

9 All of the SUT components covered under this certification met the IPv6 criteria with the exception of the Catalyst 3550. The Catalyst 3550 does not meet the critical IPv6 capability requirement in accordance with the GSCR, paragraph 1.7. However, components that are not currently IPv6 capable and have been identified by the vendor as having no migration path to IPv6, may be certified if the following criteria are met:

a. The component must already be JITC certified and currently fielded within the DSN.

b. There must be a certified, IPv6-capable component available for replacement. The Catalyst 3560 is the designated replacement.

10 The Catalyst 3550 was tested for shared access however; it failed to meet the GSCR requirements. The Catalyst 3550 is not certified for shared access and is not authorized nor approved for use within the DSN for shared access.

Table 4. ASVALAN and VALAN Component Requirements

Core/Distribution/Access Component Requirements			
Requirement	**Criteria**	**Reference**	**Critical**
CoS Models	LAN components shall support IEEE 802.1p to DSCP mapping and at least one of the following: - IEEE 802.1p/Q priority tagging/VLAN tagging - DSCP - ToS	GSCR, Appendix 3, paragraph A.3.3.2.1	Yes
Traffic Prioritization	Traffic within LAN components shall be prioritized so that voice signaling receives highest priority, voice media second highest priority, and data lowest priority.	GSCR, Appendix 3, paragraph A.3.3.2.2	Yes
QoS	LAN components shall support one of the following: - Priority Queuing - Custom Queuing - Weighted Fair Queuing - Class Based Weighted Fair Queuing	GSCR, Appendix 3, paragraph A.3.3.3.1	Yes
Policing	LAN components shall support one of the following: - DSCP PHB - Generic Traffic Shaping - Class-Based Shaping	GSCR, Appendix 3, paragraph A.3.3.3.2	Yes
VLANs	LAN components shall support: - Port based VLANs - MAC address based VLANs - Protocol based VLANs	GSCR, Appendix 3, paragraph A.3.3.3.3	Yes

Table 4. ASVALAN and VALAN Component Requirements (continued)

Core/Distribution/Access Component Requirements (continued)				
Requirement	**Criteria**		**Reference**	**Critical**
IEEE Conformance	LAN components shall support: - IEEE 802.1d – Bridging - IEEE 802.1 p/Q – Priority tagging/VLAN tagging - IEEE 802.1s – Per-VLAN Group Spanning Tree - IEEE 802.1v – VLAN Classification by port and protocol - IEEE 802.1w –Rapid Reconfiguration of Spanning Tree - IEEE 802.1x – Port Based Network Access Control - IEEE 802.3ad – Link Aggregation Protocol		GSCR, Appendix 3, paragraph A.3.3.4	Yes
Reliability	ASVALAN	LAN components shall support: - ASVALAN components shall have a reliability of .99999 or better - Dual power supplies and dual processors (more than 64 telephony subscribers) - N+1 sparing for access (more than 64 telephony subscribers) - Redundancy protocol[1] - 2 second path restoral	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
	VALAN	VALAN components shall have a reliability of .999 or better	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
Network Management	ASVALAN	LAN components shall support: - In-band or out-of-band management - SNMP - Measurements	GSCR, Appendix 3, paragraph A.3.3.4.2	Yes
	VALAN	Network Management not required for a VALAN	GSCR, Appendix 3, paragraph A.3.3.4.2	No
Security	LAN components shall employ the Network Infrastructure and VoIP STIGs.[2]		GSCR, Appendix 3, paragraph A.3.3.4.3	Yes
IPv6	All IP devices shall be IPv6 capable.[3]		GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	Yes
TE	ASVALAN	- ASVALAN components shall be engineered for a maximum of 25% voice traffic per link.[4] - For more than 64 telephony subscribers, link pairs (redundant links) must be used.	GSCR, Appendix 3, paragraph A.3.3.4.4	Yes
	VALAN	VALAN components shall be engineered for a maximum of 25% voice traffic per link.[4]	GSCR, Appendix 3, paragraph A.3.3.4.4	Yes

LEGEND:

802.1d	- Standard for Local and Metropolitan Area Networks: MAC Bridges	DSCP	- Differentiated Services Code Point
802.1p	- LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization	GSCR	- Generic Switching Center Requirements
802.1Q	- Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks	IEEE	- Institute of Electrical and Electronics Engineers, Inc.
802.1s	- Standard for Local and Metropolitan Area Networks - Amendment 3 to 802.1Q Virtual Bridged Local Area Networks: Multiple Spanning Trees	IP	- Internet Protocol
802.1v	- Standard for Local and Metropolitan Area Networks - Virtual Bridge Local Area Networks - Amendment 2: VLAN Classification by Protocol and Port (Amendment to IEEE 802.1Q, 1998 Edition)	IPv4	- Internet Protocol version 4
802.1w	- Standard for Local and metropolitan area networks - Common Specifications - Part 3: Media Access Control (MAC) Bridges: Rapid Configuration	IPv6	- Internet Protocol version 6
802.1x	- Standard for Local and Metropolitan Area Networks Port-Based Network Access Control	LAN	- Local Area Network
802.3ad	- Standard for Information Technology – Local and Metropolitan Area Networks – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications–Aggregation of Multiple Link Segments	MAC	- Media Access Control
ASVALAN	- Assured Services Voice Application LAN	Mbps	- Megabits per second
CoS	- Class of Service	N	- total VoIP users / 64
DISA	- Defense Information Systems Agency	PHB	- Per Hop Behaviors
		QoS	- Quality of Service
		SNMP	- Simple Network Management Protocol
		STIGs	- Security Technical Implementation Guides
		TE	- Traffic Engineering
		ToS	- Type of Service
		VALAN	- Voice Application LAN
		VLANs	- Virtual LANs
		VoIP	- Voice over Internet Protocol
		VRRP	- Virtual Router Redundancy Protocol

NOTES:

1 For core and distribution components, redundancy protocol shall be the routing protocol supported. For access components, redundancy protocol shall be VRRP or equivalent protocol.

2 Verified using the Information Assurance Test Plan. Results of the security testing are published in a separate test report generated by the DISA Information Assurance test personnel.

3 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor stated, in writing, compliance to the following criteria by 30 June 2008:
   a. Conformant with IPv6 standards profile contained in the Department of Defense Information Technology Standards Registry (DISR).
   b. Maintaining interoperability in heterogeneous environments and with IPv4.
   c. Commitment to upgrade as the IPv6 standard evolves.
   d. Availability of contractor/vendor IPv6 technical support.

4 Instruments connected to an access device must provide a minimum of a 10 Mbps full duplex link. For core and distribution connections, the minimum link capacity is 100 Mbps full duplex.

5. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at https://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.

6. The JITC point of contact is Mr. Edward Mellon, DSN 879-5159, commercial (520) 538-5159, FAX DSN 879-4347, or e-mail to edward.mellon@disa.mil. The tracking number for the SUT is 0636001.

FOR THE COMMANDER:

2 Enclosures a/s

MANUEL H. GARCIA, JR.
Chief
Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of Cisco Assured Services Voice Application Local Area Network (ASVALAN) and Voice Application Local Area Network (VALAN) with Specified Software Releases

Distribution:
Joint Staff J6I, Room 1E596, Pentagon, Washington, DC 20318-6000
Joint Interoperability Test Command, Liaison, ATTN: TED/JT1, 2W24-8C, P.O. Box 4502, Falls Church, VA 22204-4502
Defense Information Systems Agency, Net-Centricity Requirements and Assessment Branch, ATTN: GE333, Room 244, P.O. Box 4502, Falls Church, VA 22204-4502
Office of Chief of Naval Operations (N71CC2), CNO N6/N7, 2000 Navy Pentagon, Washington, DC 20350
Headquarters U.S. Air Force, AF/XICF, 1800 Pentagon, Washington, DC 20330-1800
Department of the Army, Office of the Secretary of the Army, CIO/G6, ATTN: SAIS-IOQ, 107 Army Pentagon, Washington, DC 20310-0107
U.S. Marine Corps (C4ISR), MARCORSYSCOM, 2200 Lester St., Quantico, VA 22134-5010
DOT&E, Net-Centric Systems and Naval Warfare, 1700 Defense Pentagon, Washington, DC 20301-1700
U.S. Coast Guard, CG-64, 2100 2nd St. SW, Washington, DC 20593
Defense Intelligence Agency, 2000 MacDill Blvd., Bldg 6000, Bolling AFB, Washington, DC 20340-3342
National Security Agency, ATTN: DT, Suite 6496, 9800 Savage Road, Fort Meade, MD 20755-6496
Director, Defense Information Systems Agency, ATTN: GS235, Room 5W24-8A, P.O. Box 4502, Falls Church, VA 22204-4502
Office of Assistant Secretary of Defense (NII)/DoD CIO, Crystal Mall 3, 7th Floor, Suite 7000, 1851 S. Bell St., Arlington, VA 22202
Office of Under Secretary of Defense, AT&L, Room 3E144, 3070 Defense Pentagon, Washington, DC 20301
U.S. Joint Forces Command, J68, Net-Centric Integration, Communications, and Capabilities Division, 1562 Mitscher Ave., Norfolk, VA 23551-2488
Defense Information Systems Agency (DISA), ATTN: GS23 (Mr. McLaughlin), Room 5W23, 5275 Leesburg Pike (RTE 7), Falls Church, VA 22041

ADDITIONAL REFERENCES

(c) Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01B, "Policy for Department of Defense Voice Services," 23 September 2001
(d) Defense Information Systems Agency (DISA), "Defense Switched Network (DSN) Generic Switching Center Requirements (GSCR), Appendix 3, Errata Change 2," 14 December 2006
(e) Executive Office of the President, "Transition Planning for Internet Protocol version 6 (IPv6)," 2 August 2005
(f) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2006

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Cisco Assured Services Voice Application Local Area Network (ASVALAN) and Voice Application Local Area Network (VALAN) with Specified Software Releases; hereinafter referred to as the system under test (SUT).

2. PROPONENT. White House Communications Agency (WHCA).

3. PROGRAM MANAGER. Lt Col Alain L. M. Jones, WHCA/J5, 2743 Defense Blvd, Anacostia Annex, District of Columbia, 20373, e-mail: ALJones@whmo.mil.

4. TESTER. Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.

5. SYSTEM UNDER TEST DESCRIPTION. The SUT is used to transport voice signaling and media as part of an overall Voice over Internet Protocol (VoIP) system. All of the SUT switches provide availability, security, and Quality of Service (QoS) to meet the operational requirements of the network and Assured Services for the warfighter. The SUT components which are bolded and underlined in the tables throughout this certification letter, are components that were tested in the JITC laboratory for this certification. The SUT components which are not bolded and not underlined but also listed throughout the tables in this letter, were determined by JITC analysis to contain the same hardware and software as, and to be functionally identical to, the tested components for interoperability certification purposes. The SUT is certified for joint use within the Defense Switched Network (DSN) with the Digital Switching Systems on the DSN Approved Products List (APL), which are certified for use with an ASVALAN or VALAN. The SUT is certified to support DSN assured services over Internet Protocol (IP) as an ASVALAN.

The SUT is composed of the following components:

The Catalyst 6500 series delivers scalable performance and port density across several chassis configurations. The Catalyst 6500 series is available in 3-, 4-, 6-, 9-, and 13-slot chassis. The Catalyst 6500 series features a range of integrated services modules, including 10-gigabit fiber cards, 1-gigabit fiber cards, and 10/100/1000BaseT Megabits per second (Mbps) switchblades used as access points. For data and voice applications, users can connect to the Local Area Network (LAN) using the 10/100/1000 BaseT Ethernet interface on the access devices. The Catalyst 6500 series is certified in the core, distribution, and access layers when deployed as a component in an ASVALAN or VALAN.

The 4500 series is available in a multi-slot chassis for gigabit fiber cards and 10/100/1000BaseT Mbps access ports to the LAN. This framework allows for a redundant architecture to ensure no single point of failure for hardware operations. Some slots are reserved for special functions such as supervisor engines. Most slots can be configured for specific user needs. All line card capabilities including bandwidth, throughputs, and routing are dependent on the supervisor engine. The Catalyst 4500

series is certified in the core, distribution, and layer when deployed as a component in an ASVALAN or VALAN with the following minor exception: The 4500 series with the SupV processor is the core, distribution, and access layers. The SupII + processor was only tested in the access layer. The Catalyst 4500 series with the SupII + processor is certified in the access layer when deployed as a component in an ASVALAN or VALAN.

The Catalyst 3750 series utilizes stackable components to provide a redundant architecture. Each switch utilizes 32-Gigabits per second (Gbps) interconnect cables on the back of each switch to connect up to nine stackable switches. Each switch contains a single power supply and processor. The stackable switches enable flexibility in creating a scalable switching platform with a variety of switching options including 12 1-Gigabit Ethernet fiber Small Form-Factor Pluggable (SFP) port switch, a 24 10/100/1000BaseT port with 4 SFP port switch, and a 48 10/100BaseT port with 4 SFP port switch. The Catalyst 3750 series is certified in the distribution and access layers when deployed as a component in an ASVALAN or VALAN.

The Cisco Catalyst 3550 series is a multilayer switch that provides high availability, QoS, and security to enhance network operations. The Cisco Catalyst 3550 series provides 24 or 48 10/100 ports and 2 1000aseX ports. The Catalyst 3550 series is certified in the access layer when deployed as a component in an ASVALAN or VALAN.

a. Core: The following switches are certified in the core layer when deployed as a component in an ASVALAN or VALAN: The Catalyst 6500 series and the Catalyst 4500 series with the SupV processor.

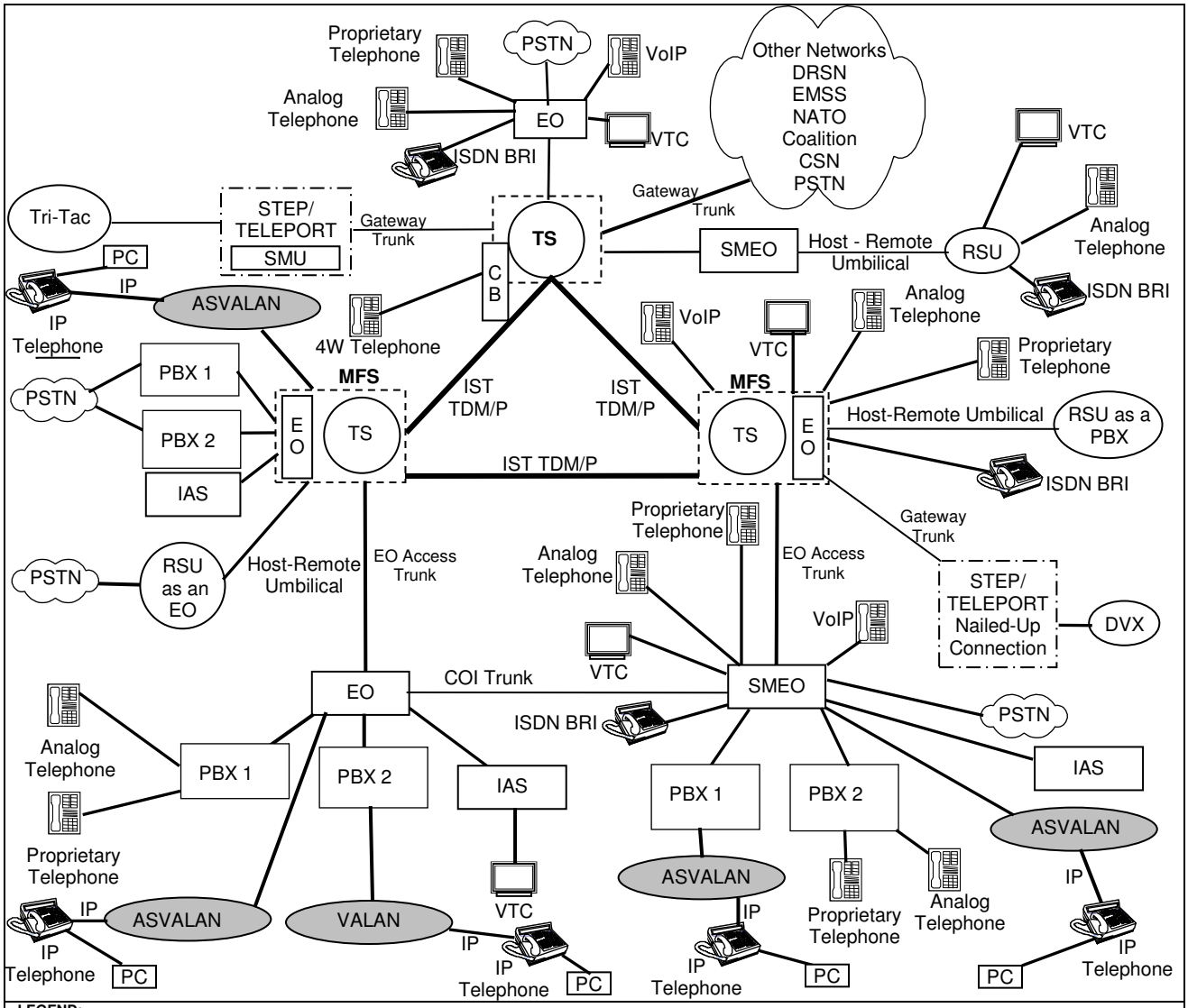
b. Distribution: The following switches are certified in the distribution layer when deployed as a component in an ASVALAN or VALAN: The Catalyst 6500 series, the Catalyst 4500 series with the SupV processor, and the Catalyst 3750 series, which can be stacked to met scalability and redundancy requirements.

c. Access: The following switches are certified in the access layer when deployed as a component in an ASVALAN or VALAN: The Catalyst 6500 series, the Catalyst 4500 series, the Catalyst 3750 series, and the Catalyst 3550 series. All SUT access layer switches can be configured and are certified for Power over Ethernet (PoE) with the following stipulations: Components which support the IEEE 802.3af standard are depicted with AF in the component title or function and they will provide PoE to any certified IP phone on the DSN APL which supports IEEE 802.3af. Other components which provide PoE but do not comply with the IEEE 802.3af standard will support any Cisco IP phone on the DSN APL. Other IP phones on the DSN APL will have to be powered by an external power supply if they are connected to a component that provides PoE but does not support the IEEE 802.3af standard. The Catalyst 3550 switch does not conform to the IEEE 802.3AF and is certified interoperable for PoE only with Cisco IP phones.

d. Shared access: Shared access (i.e., same switch port is shared by Personal Computer and IP phone), was tested and is certified with this configuration for shared

access for speeds up to 1000 Megabits per second (Mbps) full duplex. The data load was connected to the data port on the back of the IP phones at their respective maximum bandwidth (i.e. 100Mbps and 1000Mbps) using the Ixia IxExplorer. All SUT switches that provide Ethernet access ports in this certification were tested for shared access with no measurable degradation of voice quality except for the Cisco series 3550 switches. In this configuration the 3550 series switches showed degradation of voice quality; therefore this system is certified for shared access on all devices except the Catalyst 3550 series access switches.

6. OPERATIONAL ARCHITECTURE. The DSN architecture is a two-level network hierarchy consisting of DSN backbone switches and Service/Agency installation switches. Service/Agency installation switches have been authorized to extend voice services over IP infrastructures. The Generic Switching Center Requirements (GSCR) operational DSN Architecture is depicted in figure 2-1, which depicts the relationship of the ASVALAN and VALAN to the DSN switch types. The installation ASVALAN VoIP architecture is depicted in figure 2-2 and VALAN VoIP architecture is depicted in figure 2-3. The ASVALAN and VALAN combined VoIP architecture is depicted in figure 2-4.



LEGEND:

4W	- 4-Wire
ASVALAN	- Assured Services Voice Application Local Area Network
BRI	- Basic Rate Interface
CB	- Channel Bank
COI	- Community of Interest
CSN	- Canadian Switch Network
DRSN	- Defense Red Switch Network
DSN	- Defense Switched Network
DVX	- Deployable Voice Exchange
EMSS	- Enhanced Mobile Satellite System
EO	- End Office
IAS	- Integrated Access Switch
IP	- Internet Protocol
ISDN	- Integrated Services Digital Network
IST	- Interswitch Trunk
MFS	- Multifunction Switch
NATO	- North Atlantic Treaty Organization
PBX	- Private Branch Exchange
PBX 1	- Private Branch Exchange 1
PBX 2	- Private Branch Exchange 2
PC	- Personal Computer
PSTN	- Public Switched Telephone Network
RSU	- Remote Switching Unit
SMEO	- Small End Office
SMU	- Switched Multiplex Unit
STEP	- Standardized Tactical Entry Point
TDM/P	- Time Division Multiplex/Packetized
Tri-Tac	- Tri-Service Tactical Communications Program
TS	- Tandem Switch
VALAN	- Voice Application Local Area Network
VoIP	- Voice over Internet Protocol
VTC	- Video Teleconferencing
	- System Under Test

Figure 2-1. DSN Architecture

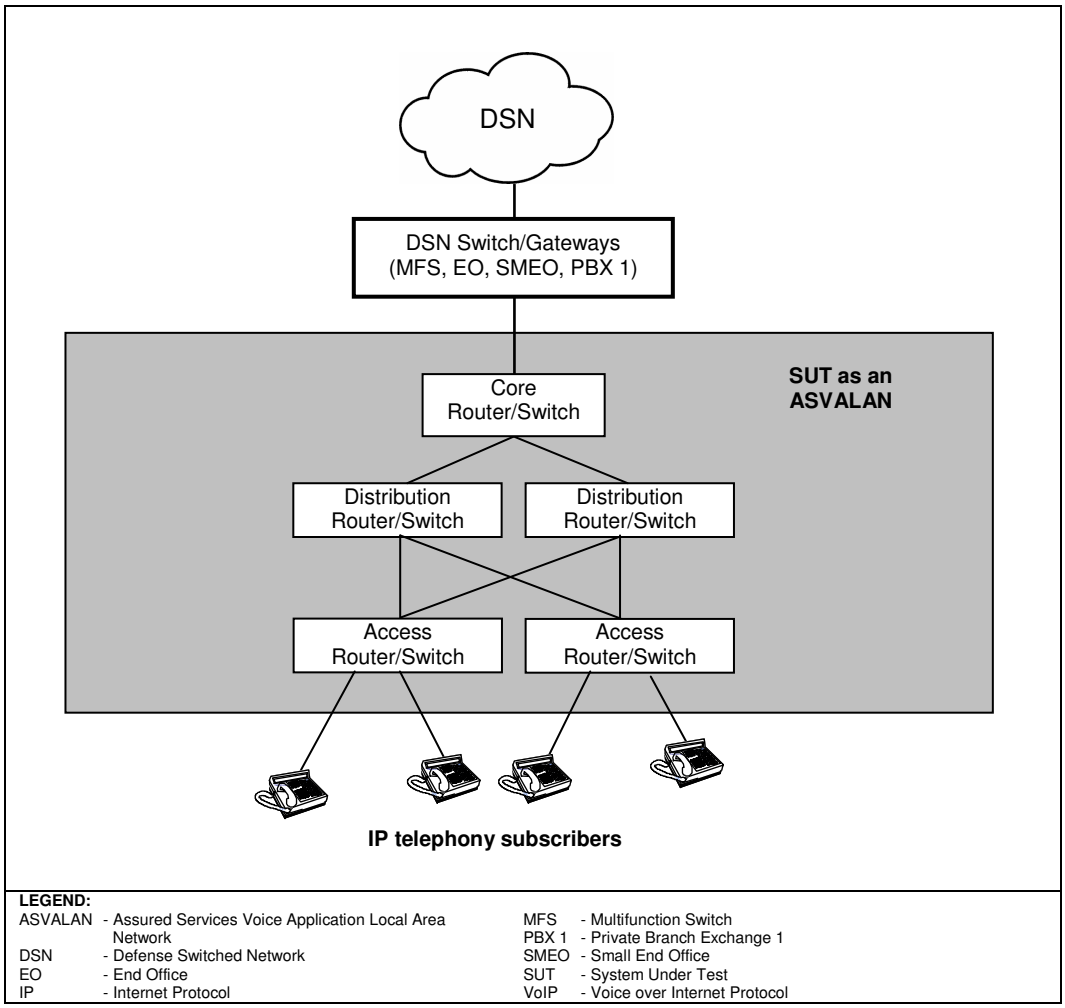
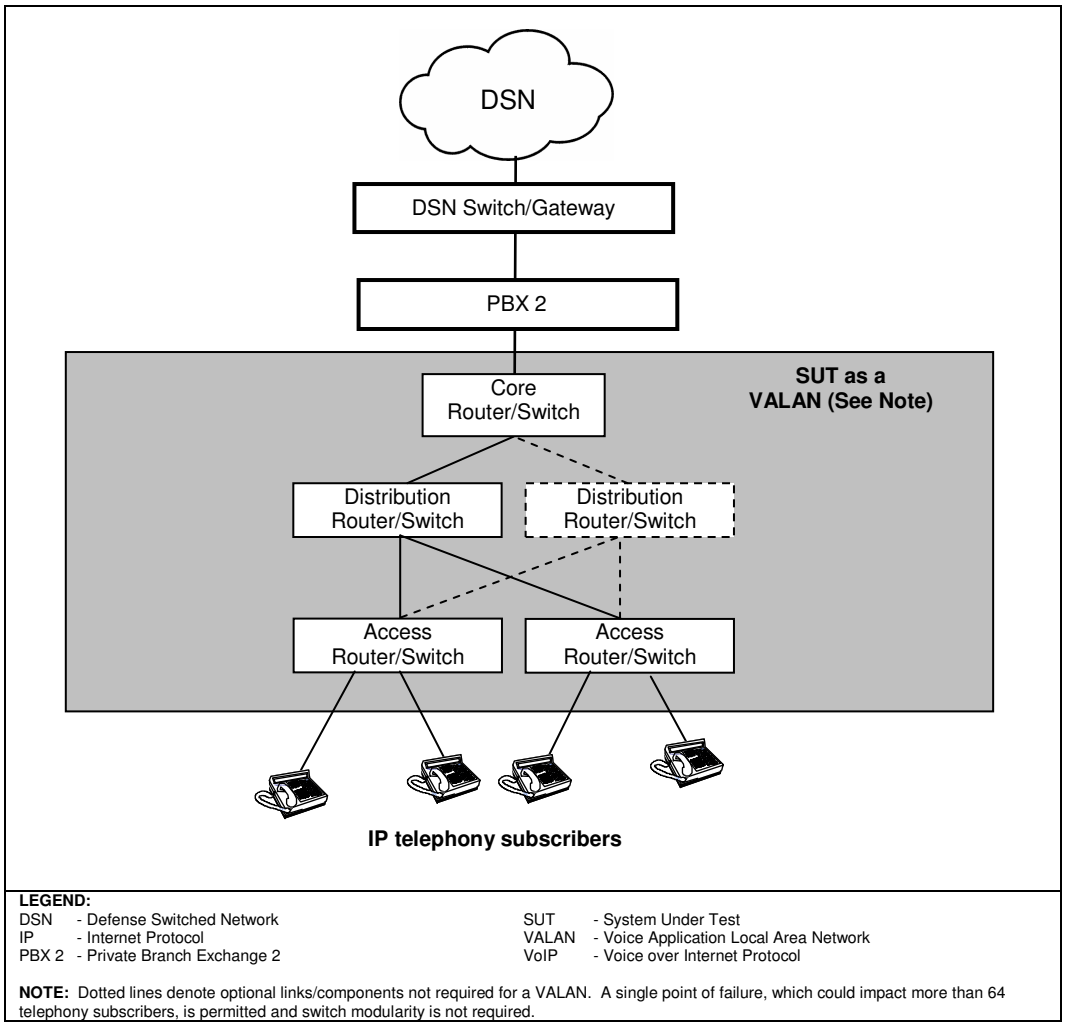


Figure 2-2. ASVALAN VoIP Architecture



LEGEND:

DSN	- Defense Switched Network	SUT	- System Under Test
IP	- Internet Protocol	VALAN	- Voice Application Local Area Network
PBX 2	- Private Branch Exchange 2	VoIP	- Voice over Internet Protocol

NOTE: Dotted lines denote optional links/components not required for a VALAN. A single point of failure, which could impact more than 64 telephony subscribers, is permitted and switch modularity is not required.

Figure 2-3. VALAN VoIP Architecture

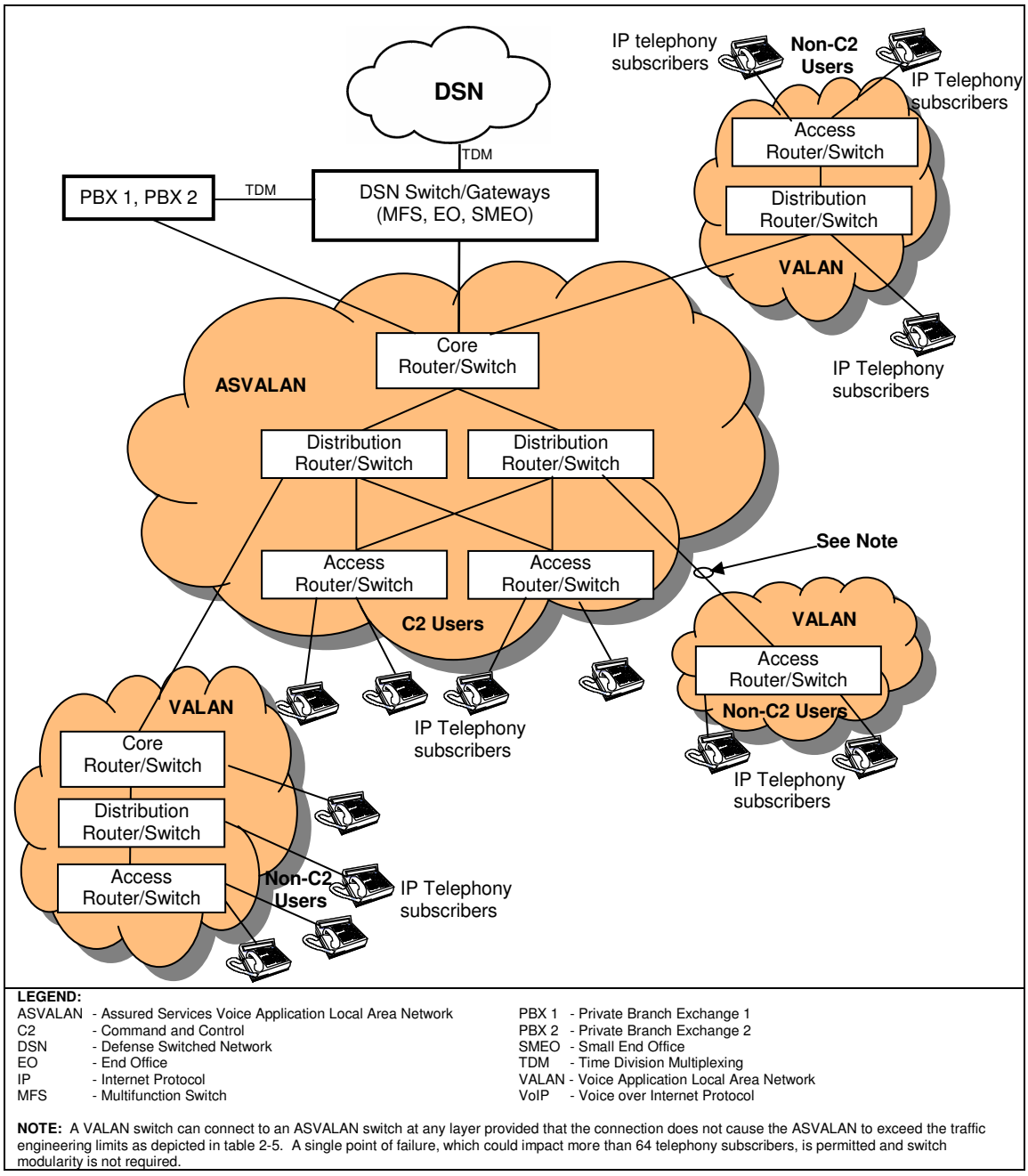


Figure 2-4. ASVALAN and VALAN Combined VoIP Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT ASVALAN and VALAN system requirements are listed in table 2-1. The requirements specific to the SUT ASVALAN and VALAN components are shown in table 2-2. These requirements are derived from:

a. DSN services for Network and Applications specified in Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01B, "Policy for Department of Defense Voice Services."

b. GSCR, appendix 3, Capability Requirements (CRs) and Feature Requirements (FRs) verified through JITC testing and/or vendor submission of Letters of Compliance (LoC).

Table 2-1. ASVALAN and VALAN System Requirements

System Requirements				
Requirement	**Criteria**		**Reference**	**Critical**
Delay	One-way packet delay for voice packets of an established call (signaling and media) shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.1	Yes
Jitter	For voice media packets, jitter shall be 5 ms or less averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.2	Yes
Packet Loss	Voice packet loss within the LAN shall not exceed 0.05% averaged over any 5-minute period.		GSCR, Appendix 3, paragraph A.3.3.1.3	Yes
Reliability	ASVALAN	- ASVALANs shall have a reliability of .99999 - No single point of failure for outage of more than 64 telephony subscribers - Network Path restores within 2 seconds	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
	VALAN	- VALANs shall have a reliability of .999	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
IPv6[1]	All IP devices shall be IPv6 capable.		GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	Yes
Security[2]	DIACAP (replacement for DITSCAP)/IA		GSCR, Appendix 3, paragraph A.3.3.4.3	Yes

LEGEND:

ASVALAN	- Assured Services Voice Application LAN	IP	- Internet Protocol
DIACAP	- DoD IA Certification and Accreditation Process	IPv4	- Internet Protocol version 4
DISA	- Defense Information Systems Agency	IPv6	- Internet Protocol version 6
DITSCAP	- DoD IT Security Certification and Accreditation Process	IT	- Information Technology
DoD	- Department of Defense	LAN	- Local Area Network
GSCR	- Generic Switching Center Requirements	ms	- milliseconds
IA	- Information Assurance	VALAN	- Voice Application LAN

NOTES:

1 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria by 30 June 2008**:**
   a. Conformant with IPv6 standards profile contained in the DoD IT Standards Registry (DISR).
   b. Maintaining interoperability in heterogeneous environments and with IPv4.
   c. Commitment to upgrade as the IPv6 standard evolves.
   d. Availability of contractor/vendor IPv6 technical support.

2 Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.

Table 2-2. ASVALAN and VALAN Component Requirements

Core/Distribution/Access Component Requirements				
Requirement	**Criteria**		**Reference**	**Critical**
CoS Models	LAN components shall support IEEE 802.1p to DSCP mapping and at least one of the following: - IEEE 802.1p/Q priority tagging/VLAN tagging - DSCP - ToS		GSCR, Appendix 3, paragraph A.3.3.2.1	Yes
Traffic Prioritization	Traffic within LAN components shall be prioritized so that voice signaling receives highest priority, voice media second highest priority, and data lowest priority.		GSCR, Appendix 3, paragraph A.3.3.2.2	Yes
QoS	LAN components shall support one of the following: - Priority Queuing - Custom Queuing - Weighted Fair Queuing - Class Based Weighted Fair Queuing		GSCR, Appendix 3, paragraph A.3.3.3.1	Yes
Policing	LAN components shall support one of the following: - DSCP PHB - Generic Traffic Shaping - Class-Based Shaping		GSCR, Appendix 3, paragraph A.3.3.3.2	Yes
VLANs	LAN components shall support: - Port based VLANs - MAC address based VLANs - Protocol based VLANs		GSCR, Appendix 3, paragraph A.3.3.3.3	Yes
IEEE Conformance	LAN components shall support: - IEEE 802.1d – Bridging - IEEE 802.1 p/Q – Priority tagging/VLAN tagging - IEEE 802.1s – Per-VLAN Group Spanning Tree - IEEE 802.1v – VLAN Classification by port and protocol - IEEE 802.1w –Rapid Reconfiguration of Spanning Tree - IEEE 802.1x – Port Based Network Access Control - IEEE 802.3ad – Link Aggregation Protocol		GSCR, Appendix 3, paragraph A.3.3.4	Yes
Reliability	ASVALAN	LAN components shall support: - ASVALAN components shall have a reliability of .99999 or better - Dual power supplies and dual processors (more than 64 telephony subscribers) - N+1 sparing for access (more than 64 telephony subscribers) - Redundancy protocol[1] - 2 second path restoral	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
	VALAN	VALAN components shall have a reliability of .999 or better	GSCR, Appendix 3, paragraph A.3.3.4.1	Yes
Network Management	ASVALAN	LAN components shall support: - In-band or out-of-band management - SNMP - Measurements	GSCR, Appendix 3, paragraph A.3.3.4.2	Yes
	VALAN	Network Management not required for a VALAN	GSCR, Appendix 3, paragraph A.3.3.4.2	No
Security	LAN components shall employ the Network Infrastructure and VoIP STIGs.[2]		GSCR, Appendix 3, paragraph A.3.3.4.3	Yes
IPv6	All IP devices shall be IPv6 capable.[3]		GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	Yes
TE	ASVALAN	- ASVALAN components shall be engineered for a maximum of 25% voice traffic per link.[4] - For more than 64 telephony subscribers, link pairs (redundant links) must be used.	GSCR, Appendix 3, paragraph A.3.3.4.4	Yes
	VALAN	VALAN components shall be engineered for a maximum of 25% voice traffic per link.[4]	GSCR, Appendix 3, paragraph A.3.3.4.4	Yes

Table 2-2. ASVALAN and VALAN Component Requirements (continued)

LEGEND:

802.1d	- Standard for Local and Metropolitan Area Networks: MAC Bridges
802.1p	- LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization
802.1Q	- Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks
802.1s	- Standard for Local and Metropolitan Area Networks - Amendment 3 to 802.1Q Virtual Bridged Local Area Networks: Multiple Spanning Trees
802.1v	- Standard for Local and Metropolitan Area Networks - Virtual Bridge Local Area Networks - Amendment 2: VLAN Classification by Protocol and Port (Amendment to IEEE 802.1Q, 1998 Edition)
802.1w	- Standard for Local and metropolitan area networks - Common Specifications - Part 3: Media Access Control (MAC) Bridges: Rapid Configuration
802.1x	- Standard for Local and Metropolitan Area Networks Port-Based Network Access Control
802.3ad	- Standard for Information Technology – Local and Metropolitan Area Networks – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications–Aggregation of Multiple Link Segments
ASVALAN	- Assured Services Voice Application LAN
CoS	- Class of Service
DISA	- Defense Information Systems Agency
DSCP	- Differentiated Services Code Point
GSCR	- Generic Switching Center Requirements
IEEE	- Institute of Electrical and Electronics Engineers, Inc.
IP	- Internet Protocol
IPv4	- Internet Protocol version 4
IPv6	- Internet Protocol version 6
LAN	- Local Area Network
MAC	- Media Access Control
Mbps	- Megabits per second
N	- total VoIP users / 64
PHB	- Per Hop Behaviors
QoS	- Quality of Service
SNMP	- Simple Network Management Protocol
STIGs	- Security Technical Implementation Guides
TE	- Traffic Engineering
ToS	- Type of Service
VALAN	- Voice Application LAN
VLANs	- Virtual LANs
VoIP	- Voice over Internet Protocol
VRRP	- Virtual Router Redundancy Protocol

NOTES:

1 For core and distribution components, redundancy protocol shall be the routing protocol supported. For access components, redundancy protocol shall be VRRP or equivalent protocol.

2 Verified using the Information Assurance Test Plan. Results of the security testing are published in a separate test report generated by the DISA Information Assurance test personnel.

3 An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor stated, in writing, compliance to the following criteria by 30 June 2008:
   a. Conformant with IPv6 standards profile contained in the Department of Defense Information Technology Standards Registry (DISR).
   b. Maintaining interoperability in heterogeneous environments and with IPv4.
   c. Commitment to upgrade as the IPv6 standard evolves.
   d. Availability of contractor/vendor IPv6 technical support.

4 Instruments connected to an access device must provide a minimum of a 10 Mbps full duplex link. For core and distribution connections, the minimum link capacity is 100 Mbps full duplex.

8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC's Global Information Grid Network Test Facility in a manner and configuration similar to that of the DSN operational environment. Figure 2-5 depicts the SUT test configuration.

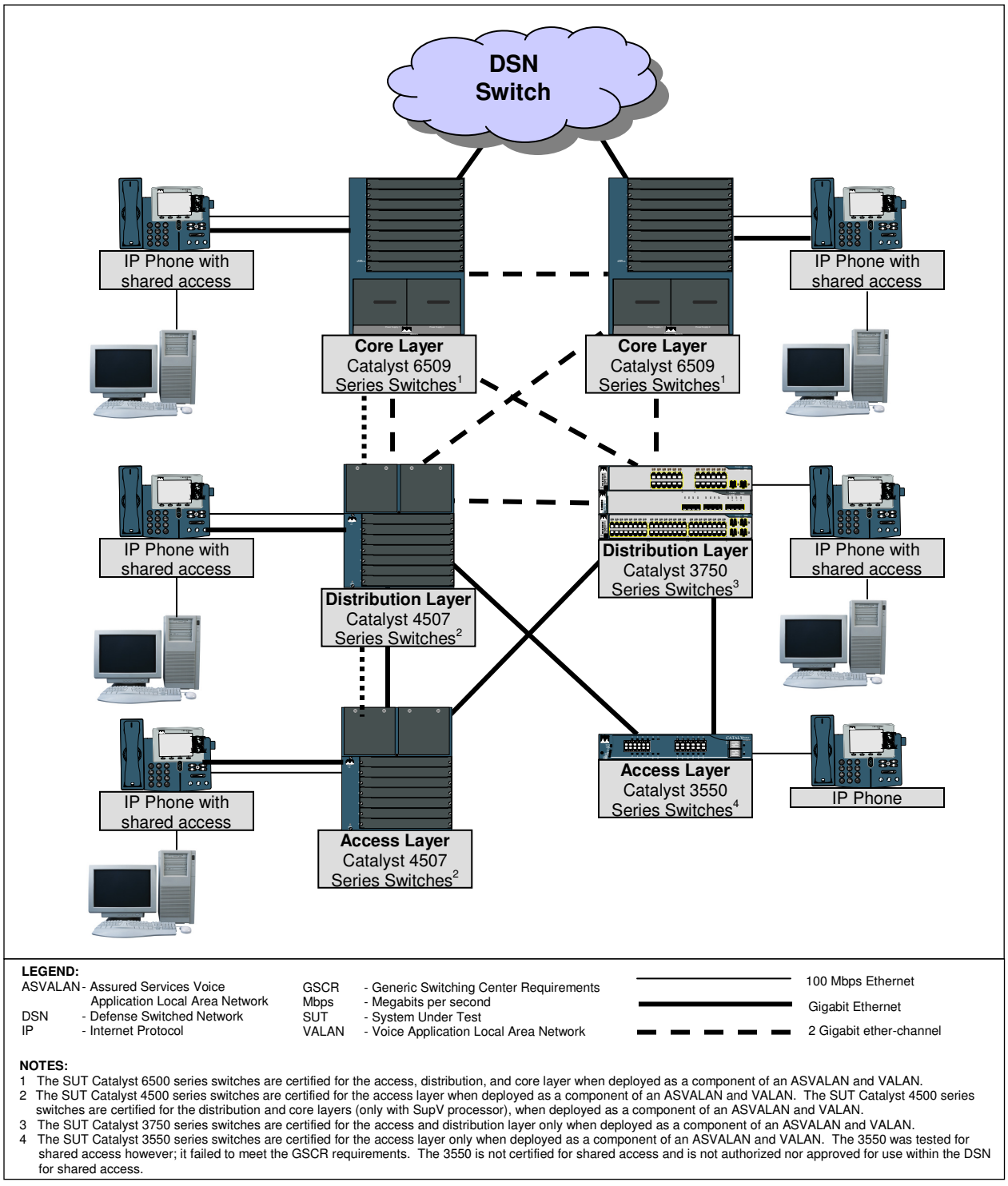


Figure 2-5. SUT Test Configuration

9. SYSTEM CONFIGURATIONS. Table 2-3 provides the tested system configurations.

Table 2-3. Tested System Configurations

System Name	Software Release	
Cisco CallManager	CCM Version 4.2(3) Service Release 1 with IOS Software Release 12.4(9) T1	
System Under Test Components with Native Specified Software Releases		
Component[1]	**Sub-component[1]**	**Function[2]**
Cisco Catalyst 6500 Series Native IOS 12.2 (18) SXF7 Release Software (fc1)	**WS-SUP720-3BXL**	Supervisor 720 Fabric MSFC3 PFC3BXL
	WS-SUP720-3B	Supervisor 720 Fabric MSFC3 PFC3B
	WS-SUP720	Supervisor 720 Fabric MSFC3 PFC3A
Cisco **6509**/**6509-E** /6509-NEB/6509-NEB-A/ 6503/6503-E /6504-E/6506/6506-E /6513	**WS-SUP32-GE-3B**[3]	Supervisor 32 with 8 GE uplinks and PFC3B
	WS-X6K-SUP2-2GE[4]	Supervisor Engine 2 with 2 GE uplinks
	WS-X6K-S2U-MSFC2[4]	Supervisor Engine 2 with PFC2, MSFC2 and 256 MB of memory
	WS-X6K-S2-MSFC2[4]	Supervisor Engine 2 with PFC2, MSFC2 and 128 MB of memory
	WS-X6148-RJ45V	48-port 10/100 Inline Power, RJ-45
	WS-X6148-RJ-45	48-Port 10/100, Upgradeable to Voice, RJ-45
	WS-X6148-RJ-21	48-Port 10/100 Upgradeable to Voice, RJ-21
	WS-X6148-RJ21V	48-port 10/100 Inline Power Module, RJ-21
	WS-X6148-45AF	PoE 802.3af 10/100, 48 port(RJ-45) line card
	WS-X6148-21AF	PoE 802.3af 10/100, 48 port (RJ-21) line card
	WS-X6148V-GE-TX	48-port 10/100/1000 Inline Power Module, RJ-45
	WS-X6148-GE-TX	48-port 10/100/1000 GE Module, RJ-45
	WS-X6148-GE-45AF	PoE 802.3af 10/100/1000, 48 port (RJ-45) line card
	WS-X6148A-GE-45AF	48-Port PoE 802.3af 10/100/1000, with Jumbo Frame
	WS-X6148A-GE-TX	48-port 10/100/1000 with Jumbo Frame, RJ-45
	WS-X6148A-RJ-45	48-Port 10/100 with TDR, Upgradeable - PoE 802.3af
	WS-X6148A-45AF	48-Port PoE 802.3af 10/100,card with TDR
	WS-X6348-RJ45V	48-port 10/100 Inline Power, RJ-45
	WS-X6348-RJ-45	48-port 10/100, RJ-45
	WS-X6348-RJ21V	48-port 10/100 Inline Power, RJ-21
	WS-X6516-GBIC	16 port GigE line card - Optical interface
	WS-X6516A-GBIC	16-port GigE Module, fabric-enabled (req. GBICs)
	WS-X6516-GE-TX	16-port 10/100/1000 GE Module, Cross-Bar
	WS-X6548V-GE-TX	48-port fabric-enabled 10/100/1000 inline power module
	WS-X6548-GE-TX	48-port fabric-enabled 10/100/1000 module
	WS-X6548-RJ-21	48-port 10/100, RJ-21, fabric-enabled
	WS-X6548-RJ-45	48-port 10/100, RJ-45, Cross-Bar
	WS-X6548-GE-45AF	PoE 802.3af 10/100/1000 48-port (RJ-45)CEF256 card
	WS-X6816-GBIC	16-port GigE module, 2 fabric I/F, (req GBICs, DFC/DFC3)
	WS-X6748-SFP	48-port GigE Module: fabric-enabled (Req. SFPs)
	WS-X6724-SFP	24-port GigE Module: fabric-enabled (Req. SFPs)
	WS-X6748-GE-TX	48-port 10/100/1000 GE Module: fabric enabled, RJ-45
	WS-X6708-10G-3CXL	8 port 10 Gigabit Ethernet module with DFC3CXL (req. X2 modules)
	WS-X6708-10G-3C	8 port 10 Gigabit Ethernet module with DFC3C (req. X2 modules)

Table 2-3. Tested System Configurations (continued)

System Under Test Components with Native Specified Software Releases		
Component[1]	**Sub-component**[1]	**Function**[2]
Cisco Catalyst 4500 Series IOS 12.2 (31) SGA1 Release Software (fc3)	**WS-X4516-10GE (SupV)**[5]	Supervisor V-10GE, 2x10GE (X2) and 4x1GE (SFP)
	WS-X4516 (SupV)[5]	Supervisor V (2 GE), Console(RJ-45)
	WS-X4013+10GE[6]	Sup II+10GE, 2x10GE (X2) and 4x1GE (SFP)
Cisco 4507R/4503[6]/4506[6] /4510R	WS-X4013+[6]	Supervisor II-Plus (IOS), 2GE, Console(RJ-45)
	WS-X4306-GB	Gigabit Ethernet Module, 6-Ports (GBIC)
	WS-X4302-GB	Gigabit Ethernet Module, 2-Ports (GBIC)
	WS-X4148-RJ45V	Pre-standard PoE 10/100, 48-Ports (RJ-45)
	WS-X4124-RJ45	10/100 Module, 24-Ports (RJ-45)
	WS-X4148-RJ45	10/100 Auto Module, 48-Ports (RJ-45)
	WS-X4148-RJ21	10/100 Module, 48-Ports Telco (4xRJ-21)
	WS-X4232-GB-RJ	32-10/100 (RJ-45),2-GE (GBIC)
	WS-X4232-RJ-XX	10/100 Module,32-ports (RJ-45)+Modular uplinks
	WS-X4248-RJ45V	PoE 802.3af 10/100, 48-Ports (RJ-45)
	WS-X4248-RJ21V	PoE 802.3af 10/100, 48-Ports (RJ-21)
	WS-X4224-RJ45V	10/100 PoE 802.3af 24-ports (RJ-45)
	WS-X4548-GB-RJ45V	PoE 802.3af 10/100/1000, 48-Ports (RJ-45)
	WS-X4548-GB-RJ45	Enhanced 48-Port 10/100/1000 BaseT (RJ-45)
	WS-X4524-GB-RJ45V	PoE 802.3af 10/ 100/1000 24-ports (RJ-45)
Cisco Catalyst 3750 Series[7] **IOS 12.2 (35) SE2 Release Software (fc1)**		**Function**[2]
WS-C3750G-12S-E	Not Applicable	12 SFP Enhanced Multilayer Image
WS-C3750G-12S-S		12 SFP Standard Multilayer Image
WS-C3750G-12S-SD		12 SFP DC powered Standard Multilayer Image
WS-C3750-24PS-E		24 10/100 PoE + 2 SFP Enhanced Image
WS-C3750-24FS-S		24 100BaseFX + 2 SFP Standard Multilayer Image
WS-C3750-24PS-S		24 10/100 PoE + 2 SFP Standard Image
WS-C3750-24TS-S		24 10/100 + 2 SFP Standard Multilayer Image
WS-C3750-24TS-E		24 10/100 + 2 SFP Enhanced Multilayer Image
WS-C3750-48PS-E		48 10/100 PoE + 4 SFP Enhanced Image
WS-C3750-48PS-S		48 10/100 PoE + 4 SFP Standard Image
WS-C3750-48TS-S		48 10/100 + 4 SFP Standard Multilayer Image
WS-C3750-48TS-E		48 10/100 PoE + 4 SFP Enhanced Image
WS-C3750G-48PS-E		48 10/100/1000T PoE + 4 SFP Enhanced Image
WS-C3750G-24T-S		24 10/100/1000T Standard Multilayer Image
WS-C3750G-24T-E		24 10/100/1000T Enhanced Multilayer Image
WS-C3750G-24TS-S		24 10/100/1000 + 4 SFP Standard Multilayer; 1.5 Rack Unit
WS-C3750G-24TS-E		24 10/100/1000 + 4 SFP Enhanced Multilayer; 1.5 Rack Unit
WS-C3750G-24TS-S1U		24 10/100/1000 + 4 SFP Standard Multilayer; 1Rack Unit
WS-C3750G-24TS-E1U		24 10/100/1000 + 4 SFP Enhanced Multilayer; 1Rack Unit
WS-C3750G-24PS-S		24 10/100/1000T PoE + 4 SFP Standard Image
WS-C3750G-24PS-E		24 10/100/1000T PoE + 4 SFP Enhanced Image
WS-C3750G-48TS-E		48 10/100/1000T + 4 SFP Enhanced Multilayer
WS-C3750G-48PS-S		48 10/100/1000T PoE + 4 SFP Standard Image
Cisco Catalyst 3550 IOS 12.2 (35) SE Release Software (fc2)		**Function**[2]
WS-C3550-24PWR-EMI[8,9]	Not Applicable	24 10/100 ports and 2 GBIC-based Gigabit Ethernet ports, integrated inline power, Enhanced Multilayer Image
WS-C3550-48-EMI[8,9]		48 10/100 ports and 2 GBIC-based Gigabit Ethernet ports, Enhanced Multilayer Image
WS-C3550-24-EMI[8,9]		24 10/100 ports and 2 GBIC-based Gigabit Ethernet ports, Enhanced Multilayer Image

Table 2-3. Tested System Configurations (continued)

LEGEND:

802.3af	- Standard for Carrier Sense Multiple Access with Collision Detection (CSMA/CD)	JITC	- Joint Interoperability Test Command
10BaseT	- 10 Mbps (Baseband Operation, Twisted Pair) Ethernet	MB	- Megabyte
100BaseT	- 100 Mbps (Baseband Operation, Twisted Pair) Ethernet	Mbps	- Megabits per second
1000BaseT	- 1000 Mbps (Baseband Operation, Twisted Pair) Ethernet	MSFC	- Multilayer Switch Feature Card
AF	- PoE IEEE 802.3af Standard	PoE	- Power Over Ethernet
APL	- Approved Products List	PS	- Pre-Standard
ASVALAN	- Assured Service Voice Application Local Area Network	PWR	- Power Over Ethernet
DC	- Direct Current	Req	- Requires
DSN	- Defense Switched Network	RJ	- Registered Jack
G, GB, Gig	- Gigabit	S	- Standard
GBIC	- Gigabit Interface Card	SD	- SFP-DC power
GE	- Gigabit Ethernet	SFP	- Small Form Factor Pluggable
GSCR	- Generic Switching Center Requirements	SUP	- Supervisor
E	- Enhanced	SUT	- System Under Test
EMI	- Enhanced Multilayer Software Image	T1	- Digital Transmission Link Level 1 (1.544 Mbps)
FS	- Fiber Switch	TDR	- Time Domain Reflectometer
IEEE	- Institute of Electrical and Electronics Engineers, Inc.	T, TS, TX	- Twisted Pair
IOS	- Internetwork Operating System	U	- Rack Unit
IPv6	- Internet Protocol version 6	VALAN	- Voice Application Local Area Network
		WS	- Workgroup Switch

NOTES:

1 Components and sub-components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same IOS software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use.

2 Components which support the IEEE 802.3af standard are depicted with AF in the component title or function and they will provide PoE to any certified IP phone on the DSN APL which supports IEEE 802.3af. Other components which provide PoE but do not comply with the IEEE 802.3af standard will support any Cisco IP phone on the DSN APL. Other IP phones on the DSN APL will have to be powered by an external power supply if they are connected to a component that provides PoE but does not support the IEEE 802.3af standard.

3 The SUP32 processor and its associated 1 Gig interfaces was tested and is only certified for an ASVALAN in a single processor dual 6500 series chassis configuration.

4 The SUP2 processor and its associated 1 Gig interfaces was tested and is only certified for an ASVALAN in a single or dual processor, dual 6500 series chassis configuration. Furthermore, the SUP2 processor is also certified in a dual processor single chassis configuration; however, in this configuration the 1 Gig interfaces are not certified for use nor approved for use within the DSN.

5 The SUPV processor includes both 1 Gig and 10 Gig fiber interfaces are covered under this certification. Both interfaces were tested and are authorized for use within the DSN.

6 The 4500 series SUP2 + processor 1 Gig and 10 Gig fiber ports did not meet the GSCR fail over requirements in a dual processor single chassis configuration in an ASVALAN. Therefore, the SUP2 + 1 Gig and 10 Gig fiber interfaces are not certified and are not authorized nor approved for use with the DSN in this configuration. The SUP2+ 1 Gig and 10 Gig fiber ports are certified for use in a single processor per chassis configuration in an ASVALAN or in a VALAN.

7 Indicates these switches support one processor and must be configured to fail over to a second switch.

8 Refer to paragraph 11 a. (3) of this enclosure. Due to a tagging problem with L2 and L3 on the Catalyst 3750 switch after a processor fail over, only the “auto qos voip trust” access port command is certified. The Cisco proprietary “auto qos cisco-phones” command is not authorized nor approved for use within the DSN.

9 All of the SUT components covered under this certification met the IPv6 criteria with the exception of the Catalyst 3550. The Catalyst 3550 does not meet the critical IPv6 capability requirement in accordance with the GSCR, paragraph 1.7. However, components that are not currently IPv6 capable and have been identified by the vendor as having no migration path to IPv6, may be certified if the following criteria are met:
   a. The component must already be JITC certified and currently fielded within the DSN.
   b. There must be a certified, IPv6-capable component available for replacement. The Catalyst 3560 is the designated replacement.

10 The Catalyst 3550 was tested for shared access however; it failed to meet the GSCR requirements. The Catalyst 3550 is not certified for shared access and is not authorized nor approved for use within the DSN for shared access.

10. TESTING LIMITATIONS. None.

11. TEST RESULTS

a. Components. The SUT met the minimum interoperability requirements of the GSCR, appendix 3, for an ASVALAN. If a system meets the minimum requirements for an ASVALAN, it also meets the lesser requirements for a VALAN. The network consisted of three main components: core switches, distribution switches, and access switches. The test results are provided below.

(1) Class of Service (CoS). The GSCR, appendix 3, paragraph A3.3.2, outlines the requirement for an ASVALAN to support IEEE, Inc. 802.1p to Differentiated Services Code Point (DSCP) mapping and one of the following three standards: IEEE 802.1p Data Link Layer 2 (L2), DSCP at the Network Layer 3 (L3), or IP Type of Service (TOS). The SUT supports the IEEE 802.1p, DSCP, and 802.1p to DSCP mapping standards. The standards were verified by capturing packets at both layers within the network.

(2) Traffic Prioritization. The GSCR, appendix 3, paragraph A3.3.2.2, outlines the requirement for an ASVALAN to prioritize converged traffic with voice signaling in the highest priority, voice media stream prioritized lower than voice signaling but higher than data, and data traffic with the lowest priority. These priorities were met by the SUT using the CoS standards listed above. At L2 using the IEEE 802.1p CoS standard, the SUT tagged packets as: Data traffic = 0, Voice media =5, and Voice Signaling and Network Management = 6. At L3 using the DSCP standard the SUT tagged packets as: Data traffic = 0, Voice media = 46, and Voice Signaling and Network Management = 48. The L3 interconnect links between all the SUT switches were configured with the following trust DSCP command: "mls qos trust dscp." All L2 SUT access ports were configured with the trust CoS command: "mls qos trust cos." To verify that the SUT met the CoS and prioritization requirements, the uplinks were saturated to their capacity with data packets tagged at 0 using the Ixia IxExplorer. At the same time, voice and signaling packets were injected across the LAN using the Ixia Chariot. These packets were tagged with a priority of 5 and 6 respectively and DSCP values were set at 46 and 48 respectively to ensure they received proper prioritization and were not delayed. In addition, flooding parameters were set to prevent broadcast and multicast traffic from overwhelming the ports. Broadcast limits were set to 5% and multicast limits were set to 70%.

(3) QoS. QoS involves giving preferential treatment through queuing, bandwidth reservation, or other methods based on attributes of the packet, such as CoS priority. A service quality is then negotiated. The GSCR, appendix 3, paragraphs 3.3.3.1 through A3.3.3.3, outline the QoS requirements for an ASVALAN in support of VoIP systems.

During fail over testing of the Cisco Catalyst 3750 switch, an anomaly was noted after the fail over of the primary processor to the backup. If a new IP Cisco phone is added and the interface is configured with "auto qos voip cisco-phones," after a fail over occurs the 3750 fails to correctly tag voice signaling and media packets at L2 and L3. Therefore, all SUT switches must configure IP phone interfaces with the "auto qos voip trust" configuration command. Furthermore; the Cisco proprietary "auto qos cisco-phones" command is not authorized nor approved for use within the DSN.

(a) Queuing. The GSCR, appendix 3, paragraph 3.3.3.1, outlines that an ASVALAN must support at least one of the following queuing mechanisms: Priority Queuing, Custom Queuing, Weighted Fair Queuing, or Class-Based Weighted Fair Queuing. The SUT supports a Class-Based Weighted Fair Queuing as required in the GSCR. Traffic classes are weighted based on criteria including access control lists (ACLs), protocols, and QoS labels. Packets meeting the criteria for a class make up the traffic for that class. A queue is reserved for each of the classes, and traffic belonging to a given class is directed to the queue for that class. Classes are assigned: bandwidth, weight, and maximum packet limit. Bandwidth assigned to any class is guaranteed for that class during times of congestion. Each class has the queue limit assigned and is the maximum amount of packets that can accumulate in the queue for the class. Packets belonging to a class are subject to bandwidth and queue limits for

the class. After a queue has reached its queue limit, queuing of additional packets to the class causes packet to be dropped.

Packets tagged with a CoS of 6 are queued in the high priority queue. The CoS values 5 and 0 are serviced in separate Weighted Round Robin, with 5 receiving a higher weight value; therefore, it will be serviced more frequently then 0. These tags were used to identify and separate traffic types as it passed through network connections ensuring voice traffic takes precedence over data traffic.

(b) Policing. Traffic Policing limits the input or output transmission rate of a class of traffic based on user-defined criteria and marks packets by setting the IP Precedence value, the QoS group, or the DSCP value. The GSCR, appendix 3, paragraph A3.3.3.2, outlines that the ASVALAN must meet at least one of the following policing mechanisms: DiffServ Per-Hop Behavior (PHB), Generic Traffic Shaping (GTS), or Class-Based Shaping (CBS). The SUT implemented Class-Based Shaping that uses DSCP values to define how traffic is treated at each individual network node. DSCP values are used from the L3 IP header. CBS shapes traffic exiting an interface and matches its speed to the distant end interface. Based on class, CBS specifies the average rate or peak rate, reduces output flow to avoid bottlenecks and ensures traffic conforms to policies setup for it. CBS uses Class-Based Weighted Fair Queuing.

(4) Virtual LAN (VLAN). The GSCR, appendix 3, paragraph A3.3.3.3 outlines that the ASVALAN shall support either implicit or explicit VLAN membership for: Port-based VLANs, Media Access Control (MAC) address-based VLANs, or Layer 3 protocol-based VLANs. The SUT supports Explicit membership for port-based VLANs. Switches within the topology were configured with multiple VLANs using the IEEE 802.1Q tag to separate data from voice traffic. MAC address and protocol-based VLANs were verified through packet captures.

(5) IEEE Conformance. All aspects of IEEE conformance were met through the LoC or testing. All test results are discussed under their respective topics.

(6) Reliability. The GSCR, appendix 3, paragraph A3.3.4.1, requires that there be no single point of failure within the ASVALAN that can cause an outage of more than 64 telephony subscribers. In order to meet the availability requirement of an ASVALAN, all switching/routing platforms that offer more than 64 telephony subscribers shall have a switch design/configuration that provides, at a minimum, dual power supplies, dual processors, redundancy protocol, and switch fabric redundancy. To meet this requirement, all links connected between the core and distribution, and between the distribution switches, as shown in figure 2-3, are configured as Port-Channels. Port-Channels must be configured on all these links. A Gigabit Port-Channel is an aggregation of two one-gigabit fiber ports to form a single two-gigabit fiber port-channel. The two fiber links must be terminated onto separate fiber cards at each switch.

The processors on the 6500 series and 4500 series switches must be configured for “Stateful Switch Over (SSO),” which is configured under the redundancy command.

"Non-stop forwarding" (NSF) must be set within the router under Open Shortest Path First (OSPF) configuration. NSF with SSO is a supervisor redundancy mechanism on the Supervisor Engines. In conjunction with SSO, NSF works to ensure L3 integrity following a switchover. Non-stop forwarding allows a router experiencing the failure of an active supervisor to continue forwarding data packets along known routes while the routing protocol information is recovered and validated. NSF relies on the separation of the control plane and the data plane during supervisor switchover. The data plane continues to forward packets based on pre-switchover Cisco Express Forwarding information. The control plane implements graceful restart routing protocol extensions to signal a supervisor restart to NSF-aware neighbor routers, inform its neighbor adjacencies, and rebuild its routing protocol database following a switchover.

On a VALAN, a single point of failure of any component or link, which impacts more than 64 telephony subscribers, is permitted. VALAN switches do not require modularity; therefore they may be integrated. VALAN reliability is required to only be .999.

(7) Network Management. The GSCR, appendix 3, paragraph A3.3.4.2, requires that the vendor provide a management system to monitor the performance of the ASVALAN portion of the VoIP system. Due to numerous third party systems and applications capable of performing this function, this requirement was verified via LoC. Network Management features and functions are not required for a VALAN.

(8) Security. Security requirements in accordance with the GSCR, appendix 3, paragraph A3.3.4.3, were verified using the Information Assurance Test Plan. Results of the security testing are reported in a separate test report generated by the DISA Information Assurance test personnel.

(9) Internet Protocol version 6 (IPv6). An IPv6 capable system or product, as defined in the GSCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of Internet Protocol version 4 (IPv4). IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor stated, in writing, compliance to the following criteria by 30 June 2008:

(a) Conformant with IPv6 standards profile contained in the DoD Information Technology Standards Registry (DISR).

(b) Maintaining interoperability in heterogeneous environments and with IPv4.

(c) Commitment to upgrade as the IPv6 standard evolves.

(d) Availability of contractor/vendor IPv6 technical support.

OSPF version two was used during the tests. OSPF version three will be required for IPv6 compatibility and was not tested. All of the SUT components covered under this certification met the IPv6 criteria with the exception of the Catalyst 3550. However, components that are not currently IPv6 capable and have been identified by the vendor as having no migration path to IPv6, may be certified if the following criteria are met:

(a) The component must already be JITC certified and currently fielded within the DSN.

(b) There must be a certified, IPv6-capable component available for replacement. To meet this requirement Cisco has designated the Catalyst 2960 as a replacement.

(10) Traffic Engineering

(a) Links. To meet the ASVALAN requirements, two Gigabit Port-Channels were configured between the core and distribution switches, and between the distribution switches. The Port-Channels were configured to separate fiber cards on each switch to ensure proper redundancy. Port-Channels provide flexible, scalable bandwidth with resiliency and load sharing across links for switches and router interfaces. Ten gigabit links were also configured between the core, distribution, and access layer Catalyst 6509 and Catalyst 4507 switches. A VALAN only requires a single link between the different switch elements.

(b) Scalability. The SUT can be scaled to meet any number of IP phone subscribers as long as the SUT is composed of the equipment and software listed in table 2-3, and are consistent with traffic engineering constraints contained in the GSCR, appendix 3. Table 2-4, which was approved by the DSN Configuration Control Board (DSN CCB) on Dec 2004, outlines the maximum number of subscribers that can be supported per each link capacity.

Table 2-4. IP Subscriber Supportability by Link Capacity

Link Type	LAN BW	Users
Non-Converged	10 Mbps	64[1]
	100 Mbps	64[1]
	1 Gbps	64[1]
	10 Gbps	64[1]
	10 Mbps LP	100[2]
	100 Mbps LP	1000[2]
	1 Gbps LP	10000[2]
	10 Gbps LP	100000[2]
Converged	10 Mbps	25[3]
	100 Mbps	64[1]
	1 Gbps	64[1]
	10 Gbps	64[1]
	10 Mbps LP	25[3]
	100 Mbps LP	250[4]
	1 Gbps LP	2500[4]
	10 Gbps LP	25000[4]

LEGEND:

ASVALAN	- Assured Services Voice Application LAN	kbps	- kilobits per second
BW	- Bandwidth	LAN	- Local Area Network
Gbps	- Gigabits per second	LP	- Link Pair
IP	- Internet Protocol	Mbps	- Megabits per second

NOTES:

1 For single links, number of telephony subscribers is limited to a maximum of 64 because of single point of failure. This limit applies specifically to ASVALANs.
2 The number of users is calculated as bandwidth (BW) divided by 100 kbps per user.
3 The number of users was limited to 64 telephony subscribers per note 1 or 25% of total users per note 1, whichever was less.
4 For the converged network, voice traffic was engineered not to exceed 25 % of total utilization using an estimated 100 kbps per voice call.

(11) LAN Architectures. To meet the ASVALAN fail over requirements, OSPF was implemented between the core and distribution layer. OSPF utilizes link-state protocols to identify lowest cost paths within the LAN. In addition, Hot Standby Router Protocol (HSRP) was implemented to allow for sub-second detection of failed links. HSRP is required to support redundancy between multilink layer 2 devices. Measured fail over for the L2 switches and paths was also less than two seconds. These rapid responses were due to HSRP running between key elements of the SUT. For VALANs which use a single link, redundancy protocols are not applicable.

(a) Delay. The GSCR, appendix 3, paragraph A3.3.1.1, states the one-way packet delay shall be five milliseconds (ms) or less, as measured over a five-minute period. The average one-way delay for each of the sampled five-minute periods, measured between the access and core devices, was 0.022 ms, with a maximum delay of 1.0 ms, which met the requirement.

(b) Jitter. The GSCR, appendix 3, paragraph A3.3.1.2 states jitter for voice media packets will be 5 ms or less as averaged over any five-minute period. With a 100% bandwidth load, jitter was measured to be 0.00 ms over a five-minute period, which met the requirement.

(c) Packet Loss. Network packet loss occurs when packets are sent, but not received at the final destination. The GSCR, appendix 3, paragraph A3.3.1.3, states

that LANs shall be engineered so the measured voice packet loss within the LAN shall not exceed 0.05% averaged over any five-minute period. With 100% bandwidth load, the measured packet loss was 0.00% over a five minute period.

b. System Interoperability Results. The SUT is certified for joint use within the DSN with the Digital Switching Systems on the DSN APL which are certified for use with an ASVALAN or VALAN. The SUT is certified to support DSN assured services over IP as an ASVALAN in accordance with the requirements set forth in the GSCR, appendix 3. The SUT is also certified as a VALAN. However, since VALANs do not support the Assured Services Requirements detailed in reference (c), C2 users and Special C2 users are not authorized to be served by a VALAN. Since VALANs do not support Assured Services, they can only serve DoD, non-DoD, non-governmental, and foreign government users having no missions or communications requirement to ever originate or receive C2 communications. VALAN connectivity to the DSN is not authorized until a waiver is granted by the Joint Staff for each site. The system interoperability test summary is shown in table 2-5 and the detailed component interoperability test status is shown table 2-6.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at https://stp.fhu.disa.mil. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at https://jit.fhu.disa.mil (NIPRNet), or http://199.208.204.125 (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at http://jitc.fhu.disa.mil/tssi.

Table 2-5. SUT System Interoperability Test Summary

Device Requirement[1]	Reference	Test Results	Remarks
Delay measured at 5 ms or less	GSCR, Appendix 3, paragraph A3.3.1.1	Met	The average was 0.022 ms and the maximum was 1.0 ms.
Jitter measured at less than 5 ms	GSCR, Appendix 3, paragraph A3.3.1.2	Met	Measured to be 0.00 ms.
Packet Loss less than 0.05%	GSCR, Appendix 3, paragraph A3.3.1.3	Met	Measured to be 0.00%.
Reliability	GSCR, Appendix 3, paragraph A.3.3.4.1	Met	See note 2.
IPv6	GSCR, Appendix 3, paragraph A3.2.8	Met	See note 3.
Security	GSCR, Appendix 3, paragraph A3.2.4	Met	See note 4.

LEGEND:

ASVALAN	- Assured Services Voice Application Local Area Network	JITC	- Joint Interoperability Test Command
DISA	- Defense Information Systems Agency	ms	- millisecond
DSN	- Defense Switched Network	SUT	- System Under Test
GSCR	- Generic Switching Center Requirements	VALAN	- Voice Application Local Area Network
IPv6	- Internet Protocol version 6		

NOTES:

1 If a system meets the minimum requirements for an ASVALAN, it also meets the lesser requirements for a VALAN.

2 A single point of failure of any component or link, which impacts more than 64 telephony subscribers on a VALAN, is permitted. VALAN switches do not require modularity; therefore they may be integrated. VALAN reliability is required to only be .999.

3 All of the SUT components covered under this certification met the IPv6 criteria with the exception of the Catalyst 3550. The Catalyst 3550 does not meet the critical IPv6 capability requirement in accordance with the GSCR, paragraph 1.7. However, components that are not currently IPv6 capable and have been identified by the vendor as having no migration path to IPv6, may be certified if the following criteria are met:

a. The component must already be JITC certified and currently fielded within the DSN.

b. There must be a certified, IPv6-capable component available for replacement. The Catalyst 3560 is a designated replacement.

4 Security is tested by DISA-led Information Assurance test teams and published in a separate report.

Table 2-6. Component Interoperability Test Summary

Interface	Component[1]	Status	Device Requirement	Test Results	Reference	Remarks
10000 BaseFX 1000BaseFX 10/100/1000 BaseTX	**Cisco Catalyst 6500 Series Native IOS 12.2 (18) SXF7 Release Software (fc1)**	Certified as: Core Distribution Access	CoS Models	Met	GSCR, Appendix 3, paragraph A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, paragraph A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, paragraph A3.3.3.1	
	Cisco **6509**/ **6509-E** /6509-NEB/ 6509-NEB-A/ 6503/6503-E /6504-E /6506/6506-E /6513		Policing	Met	GSCR, Appendix 3, paragraph A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, paragraph A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, paragraph A3.3.4	
			Reliability	Met	GSCR, Appendix 3, paragraph A3.3.4.1	A VALAN requires no redundancy and only .999 reliability.[1]
			Network Management	Met	GSCR, Appendix 3, paragraph A.3.3.4.2	Network Management is not a requirement for a VALAN.[1]
			Security	Met	GSCR, Appendix 3, paragraph A.3.3.4.3	See note 2.
			IPv6	Met	GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	See note 3.
			TE	Met	GSCR, Appendix 3, paragraph A.3.3.4.4	For a VALAN, redundant links are not required.[1]
1000BaseFX 10/100/1000 BaseTX	**Cisco Catalyst 4500 Series IOS 12.2 (31) SGA1 Release Software (fc3)**	Certified as: Core[4] Distribution[4] Access	CoS Models	Met	GSCR, Appendix 3, paragraph A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, paragraph A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, paragraph A3.3.3.1	
	Cisco **4507R**/4503/ 4506/4510R		Policing	Met	GSCR, Appendix 3, paragraph A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, paragraph A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, paragraph A3.3.4	
			Reliability	Met	GSCR, Appendix 3, paragraph A3.3.4.1	A VALAN requires no redundancy and only .999 reliability.[1]
			Network Management	Met	GSCR, Appendix 3, paragraph A.3.3.4.2	Network Management is not a requirement for a VALAN.[1]
			Security	Met	GSCR, Appendix 3, paragraph A.3.3.4.3	See note 2.
			IPv6	Met	GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	See note 3.
			TE	Met	GSCR, Appendix 3, paragraph A.3.3.4.4	For a VALAN, redundant links are not required.[1]

Table 2-6. Component Interoperability Test Summary (continued)

Interface	Component[1]	Status	Device Requirement	Test Results	Reference	Remarks
1000BaseFX 10/100/1000 BaseTX	**Cisco Catalyst 3750 Series[5] IOS 12.2 (35) SE2 Release Software (fc1)** **WS-C3750G-12S-E** WS-C3750G-12S-S WS-C3750G-12S-SD **WS-C3750-24PS-E** WS-C3750-24FS-S WS-C3750-24PS-S WS-C3750-24TS-S WS-C3750-24TS-E **WS-C3750-48PS-E** WS-C3750-48PS-S WS-C3750-48TS-S WS-C3750-48TS-E **WS-C3750G-48PS-E** WS-C3750G-24T-S WS-C3750G-24T-E WS-C3750G-24TS-S WS-C3750G-24TS-E WS-C3750G-24TS-S1U WS-C3750G-24TS-E1U WS-C3750G-24PS-S WS-C3750G-24PS-E WS-C3750G-48TS-E WS-C3750G-48PS-S	Certified as: Distribution Access	CoS Models	Met	GSCR, Appendix 3, paragraph A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, paragraph A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, paragraph A3.3.3.1	See note 5.
			Policing	Met	GSCR, Appendix 3, paragraph A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, paragraph A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, paragraph A3.3.4	
			Reliability	Met	GSCR, Appendix 3, paragraph A3.3.4.1	A VALAN requires no redundancy and only .999 reliability.[1]
			Network Management	Met	GSCR, Appendix 3, paragraph A.3.3.4.2	Network Management is not a requirement for a VALAN.[1]
			Security	Met	GSCR, Appendix 3, paragraph A.3.3.4.3	See note 2.
			IPv6	Met	GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	See note 3.
			TE	Met	GSCR, Appendix 3, paragraph A.3.3.4.4	For a VALAN, redundant links are not required.[1]

Table 2-6. Component Interoperability Test Summary (continued)

Interface	Component[1]	Status	Device Requirement	Test Results	Reference	Remarks
1000BaseFX 10/100Base TX	**Cisco Catalyst 3550 IOS 12.2 (35) SE Release Software (fc2)**	Certified as: Access	CoS Models	Met	GSCR, Appendix 3, paragraph A3.3.2.1	
			Traffic Prioritization	Met	GSCR, Appendix 3, paragraph A3.3.2.2	
			QoS	Met	GSCR, Appendix 3, paragraph A3.3.3.1	
	WS-C3550-24PWR-EMI WS-C3550-48-EMI WS-C3550-24-EMI		Policing	Met	GSCR, Appendix 3, paragraph A3.3.3.2	
			VLANs	Met	GSCR, Appendix 3, paragraph A3.3.3.3	
			IEEE Conformance	Met	GSCR, Appendix 3, paragraph A3.3.4	
			Reliability	Met	GSCR, Appendix 3, paragraph A3.3.4.1	A VALAN requires no redundancy and only .999 reliability.[1]
			Network Management	Met	GSCR, Appendix 3, paragraph A.3.3.4.2	Network Management is not a requirement for a VALAN.[1]
			Security	Met	GSCR, Appendix 3, paragraph A.3.3.4.3	See note 2.
			IPv6	Met	GSCR paragraph 1.7, and GSCR, Appendix 3, paragraph A3.2.8	See note 3.
			TE	Met	GSCR, Appendix 3, paragraph A.3.3.4.4	For a VALAN, redundant links are not required.[1]

LEGEND:

10/100/1000BaseTX	- 10/100/1000 Mbps Ethernet over Category 5 Twisted Pair Copper
1000BaseFX	- 1000 Mbps Ethernet over fiber
10000BaseFX	- 10000 Mbps Ethernet over fiber
ASVALAN	- Assured Services Voice Application Local Area Network
CoS	- Class of Service
DISA	- Defense Information Systems Agency
DC	- Direct Current
DSN	- Defense Switched Network
E	- Enhanced
EMI	- Enhanced Multilayer Software Image
FS	- Fiber Switch
GSCR	- Generic Switching Center Requirements
IEEE	- Institute of Electrical and Electronics Engineers, Inc.
JITC	- Joint Interoperability Test Command
IPv6	- Internet Protocol version 6
L2	- Layer 2
L3	- Layer 3
Mbps	- Megabits per second
PS	- Pre-Standard
PWR	- Power over Ethernet
QoS	- Quality of Service
-S	- Standard
SD	- SFP-DC Power
SFP	- Small Form Factor Pluggable
T, TS	- Twisted Pair
TE	- Traffic Engineering
U	- Rack Unit
VALAN	- Voice Application Local Area Network
VLAN	- Virtual Local Area Network

NOTES:

1 If a system meets the requirements for an ASVALAN, it also meets the lesser requirements for a VALAN.

2 Security is tested by DISA-led Information Assurance test teams and published in a separate report.

3 All of the SUT components covered under this certification met the IPv6 criteria with the exception of the Catalyst 3550. The Catalyst 3550 does not meet the critical IPv6 capability requirement in accordance with the GSCR, paragraph 1.7. However, components that are not currently IPv6 capable and have been identified by the vendor as having no migration path to IPv6, may be certified if the following criteria are met:
   a. The component must already be JITC certified and currently fielded within the DSN.
   b. There must be a certified, IPv6-capable component available for replacement. The Catalyst 3560 is a designated replacement.

4 The Catalyst 4500 series is certified in the core and distribution layer only with the SupV processor.

5 Refer to paragraph 11 a. (3) in this enclosure. Due to a tagging problem with L2 and L3 on the Catalyst 3750 switch after a processor fail over, only the “auto qos voip trust” access port command is certified. The Cisco proprietary “auto qos cisco-phones” command is not authorized nor approved for use within the DSN.